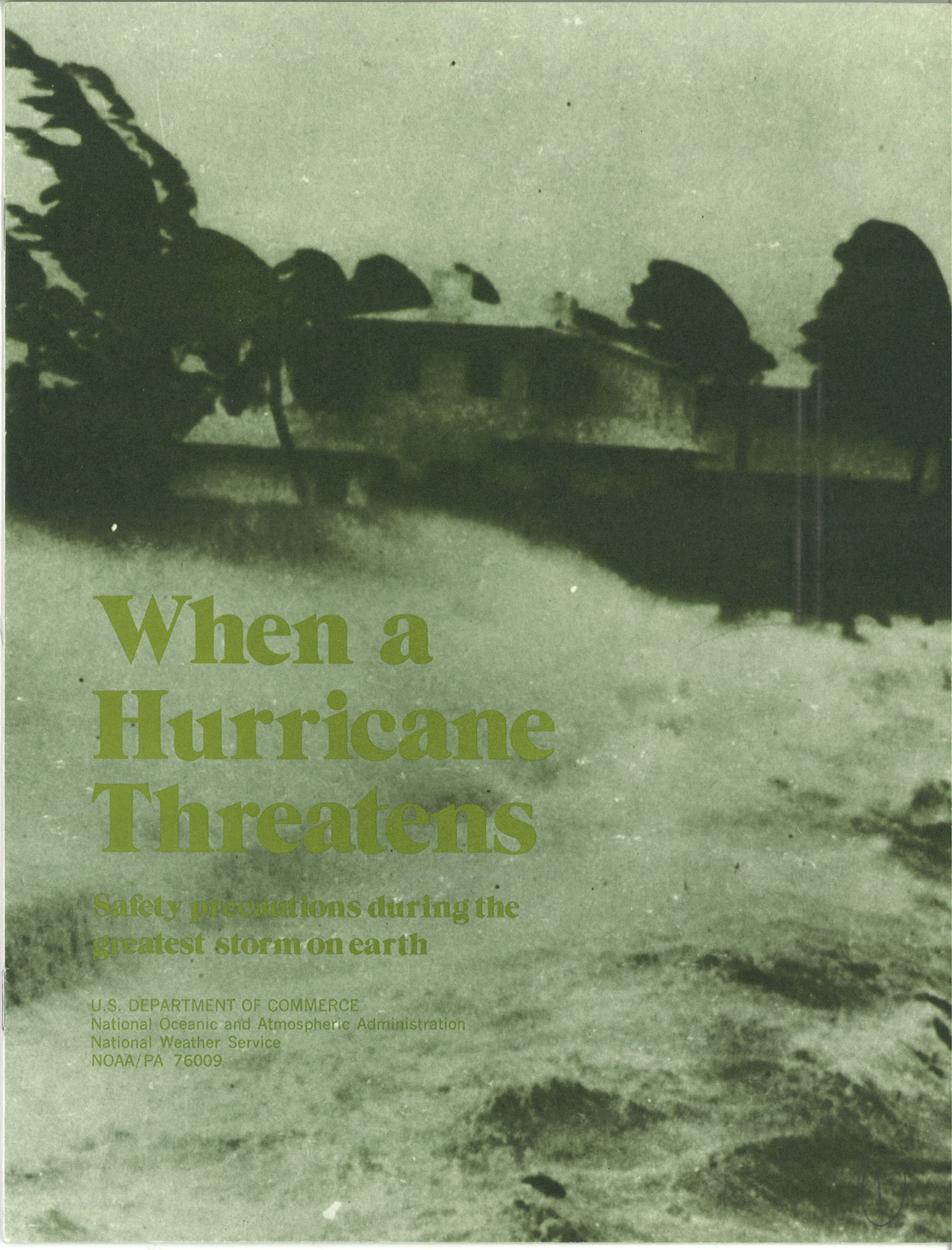
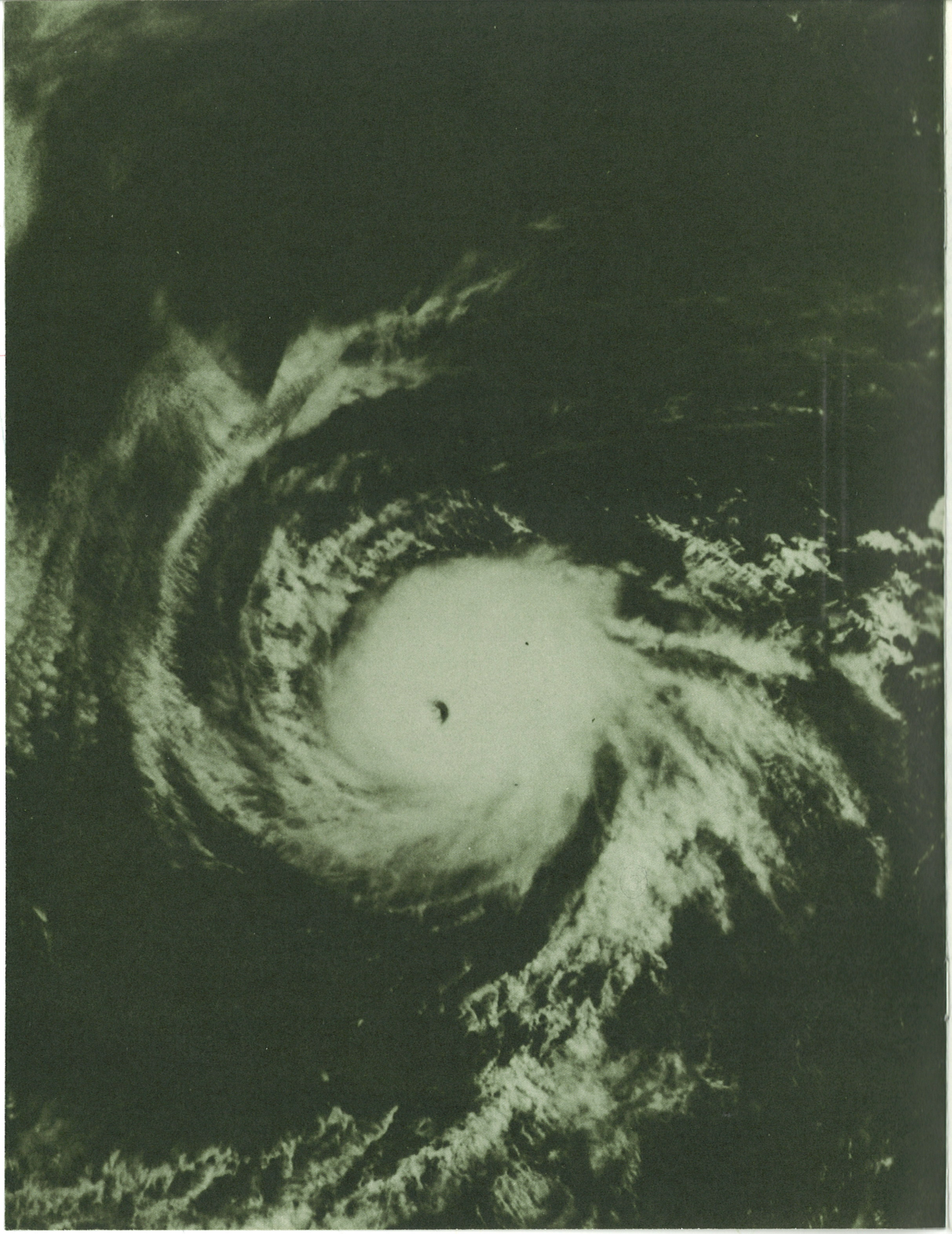


When a Hurricane Threatens

Safety precautions during the greatest storm on earth

U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Weather Service
NOAA/PA 76009



THE GREATEST STORM ON EARTH...

The hurricane is a large circular storm of awful violence. Winds in the storm reach at least 74 miles an hour or greater, and may gust as high as 200 miles an hour. On the average, its great spiral clouds cover an area several hundred miles in diameter. The spirals are heavy cloud bands from which torrential rains fall. They are separated by areas of light rain or no rain at all. Tornado activity may be generated in these spiral cloud bands.

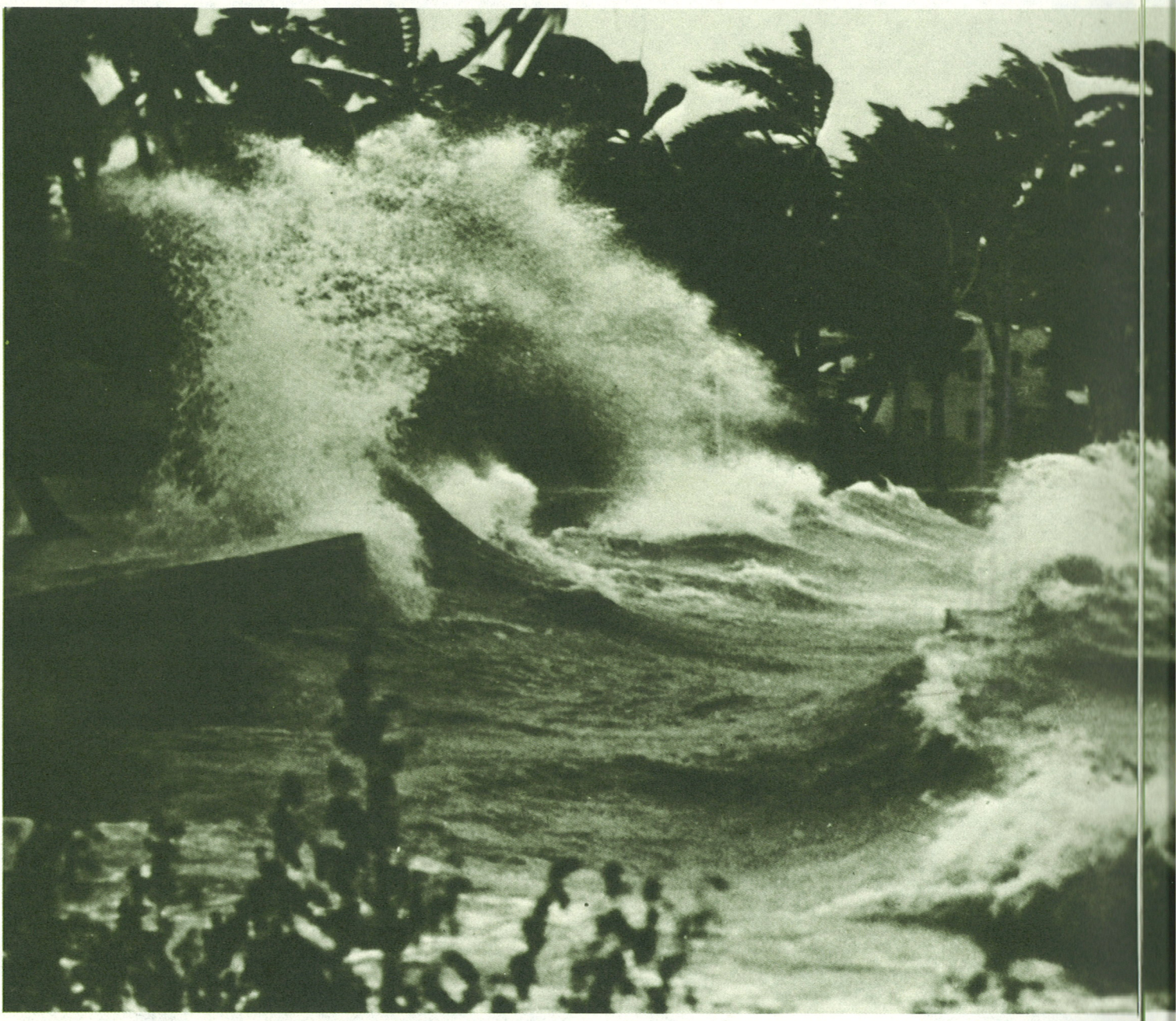
Hurricanes may move quite erratically. They can suddenly change direction, make loops, slow up or stop—and later on move at 10 to 20 miles an hour. Some hurricanes along the mid-Atlantic and New England coasts move at more than 30 miles an hour.

The hurricane's eye is unique, as no other atmosphere phenomenon has a center almost free of clouds, with very light winds and warm temperatures surrounded by a doughnut shaped area of maximum winds. On the average eye diameter is about 25 miles although diameters of 50 miles are not unusual.

The destruction caused by these giant storms is legend. The death and damage is caused by wind, flood-produced rains, and, most lethal of all, the storm surge.

The worst natural disaster in the history of the United States came

OK
AVA
6/7/1973



as the result of a hurricane which struck Galveston, Texas, in 1900. The storm, which hit the Texas coast on September 8, caused more than 6,000 deaths. Weather warnings were ineffectual. The people of Galveston, unprepared for a storm of such intensity, were helpless in the face of the hurricane.

Statistics alone cannot tell the story of the suffering and personal loss brought by these dread storms whose potential for death and destruction has given them the undisputed title of "The Greatest Storms on Earth."

But the hurricane is no longer the unheralded killer it once was. The day that such a storm could strike an unsuspecting, unprepared public without warning is long past. The National Oceanic and Atmospheric Administration (NOAA) of the U.S. Department of Commerce mounts a yearly watch for the early detection of hurricanes. NOAA's environmental satellites, thousands of miles out in space, may give the first clues to the formation of the storm. NOAA research planes and hurricane reconnaissance flights by military aircraft assure accurate tracking of the hurricane as it nears the North American continent. Many ocean-going ships routinely report weather at sea to weather stations on shore. Along the Gulf and Atlantic coasts of the U.S., a network of National Weather Service high-powered

radars are ready for detection and tracking duties should a hurricane approach.

At the National Hurricane Center in Miami, Florida, skilled meteorologists of the National Weather Service will track and forecast the storm's course and intensity and issue warnings. At their disposal are the latest products of technology: high speed computers, worldwide communications, data from satellites, radar, aircraft, ocean buoys, oil rigs, and ships.

The Greatest Storm on Earth is still entitled considerable respect because of its deadly storm surge, winds, and flood waters. Warnings are of no value if they go unheeded. Experience and common sense have taught some coastal dwellers how to cope with the hurricane. But there are always newcomers. Millions of people living along the Atlantic and Gulf coasts have never experienced a hurricane. Many have been through the fringes of a hurricane and have a false sense of security.

This pamphlet is designed to tell you what you can do to protect yourself and your family when a hurricane threatens.

The Killers:

STORM SURGE

The storm surge is a great dome of water often 50 miles wide, that comes sweeping across the coastline near the area where the eye of the hurricane makes landfall. The surge, aided by the hammering effect of breaking waves, acts like a giant bulldozer sweeping everything in its path. The stronger the hurricane, the higher the storm surge will be. This is unquestionably the most dangerous part of a hurricane. Nine out of ten hurricane fatalities are caused by the storm surge. During the infamous Hurricane Camille in 1969, a 25-foot storm surge inundated Pass Christian in Mississippi. Lesser heights are more usual but still extremely dangerous.

Artist's conception of storm surge and wave action approaching a coastal community

Action Checklist

Stay tuned to radio, television, or NOAA Weather Radio for weather bulletins and official reports. Have battery operated radio available.

If you are advised to evacuate, do so at once.

Move away from beaches and bays where the surge will be most devastating.

Know in advance whether your residence can be reached by the storm surge.

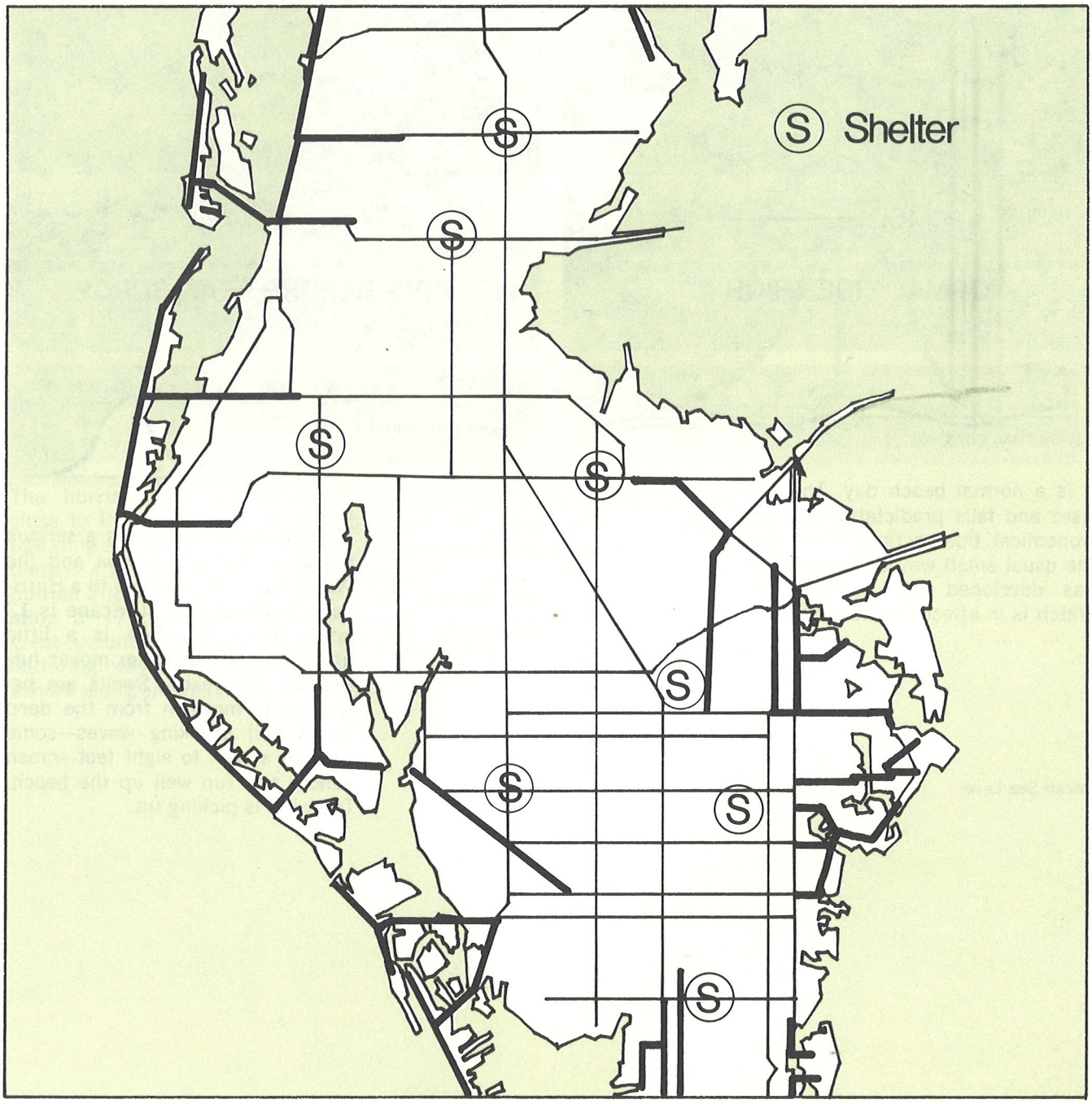
Know where the nearest designated shelter is and how to reach it by a safe evacuation route.

Keep your car's gas tank full.

Watch for rising water.

Shut off electrical power at the main switch and water at a main valve before evacuating.

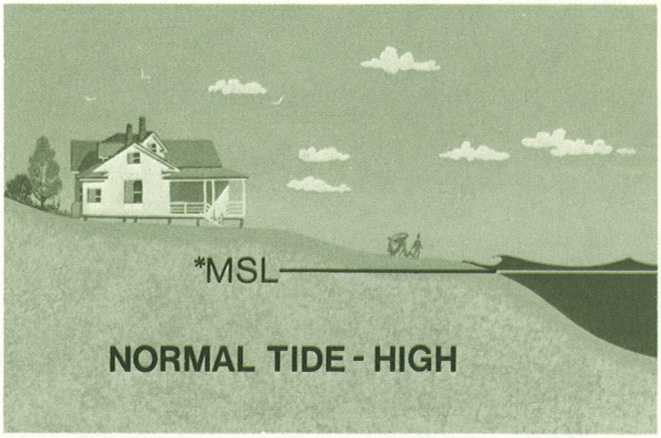
If you must evacuate after the hurricane's effects begin, use caution. Flooding may undermine roads. Watch out for downed power lines and other road hazards.

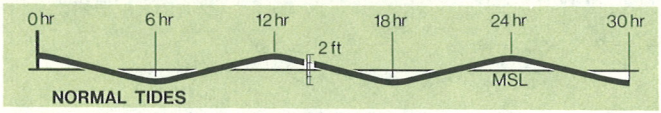


Storm Surge:

THE MOST DEADLY KILLER

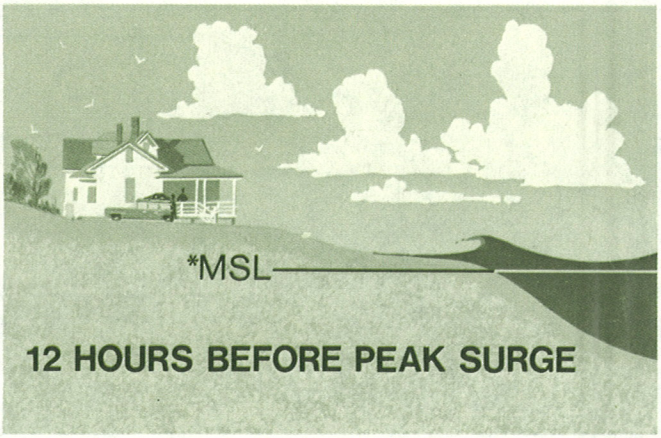
The three sets of drawings on these pages show the formation and effects of the hurricane storm surge. Many factors are involved in the formation and propagation of a storm surge such as the strength of the storm, bottom conditions where the surge comes ashore, and the position of the storm center in relation to the shore. These diagrams, therefore, cannot be representative of all surges for all coastal areas. The surge diagrammed here is typical of those produced by a hurricane approaching the lower-Atlantic or Gulf coastal areas.

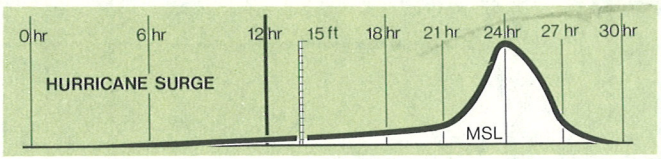




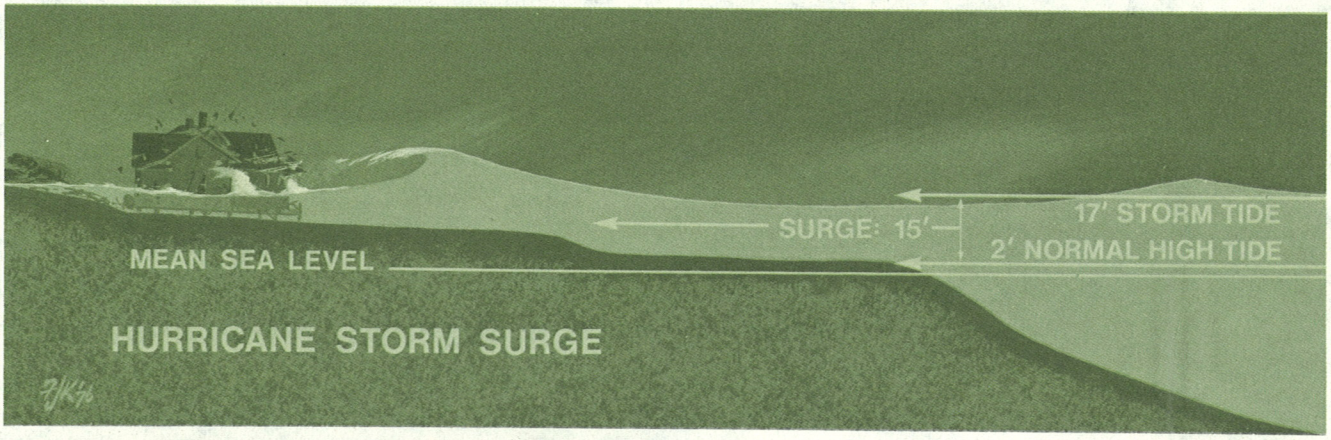
It is a normal beach day. The sea rises and falls predictably with astronomical tidal action. There are the usual small waves. A hurricane has developed and a Hurricane Watch is in effect for the area.

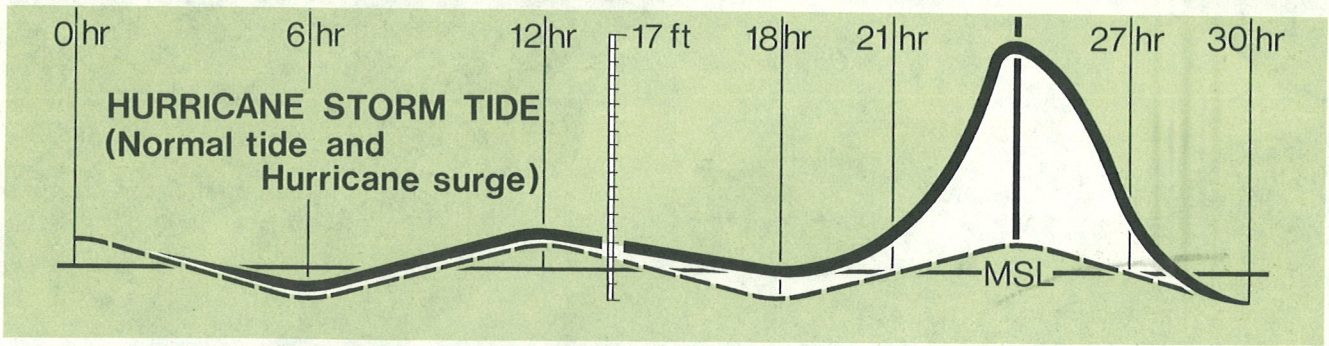
*Mean Sea Level





The hurricane now poses a serious threat to this beach area and the Watch has been changed to a Hurricane Warning. The hurricane is 12 hours away. The tide is a little above normal; the water moves further up the beach. Swells are beginning to move in from the deep ocean and breaking waves—some as high as five to eight feet—crash ashore and run well up the beach. The wind is picking up.

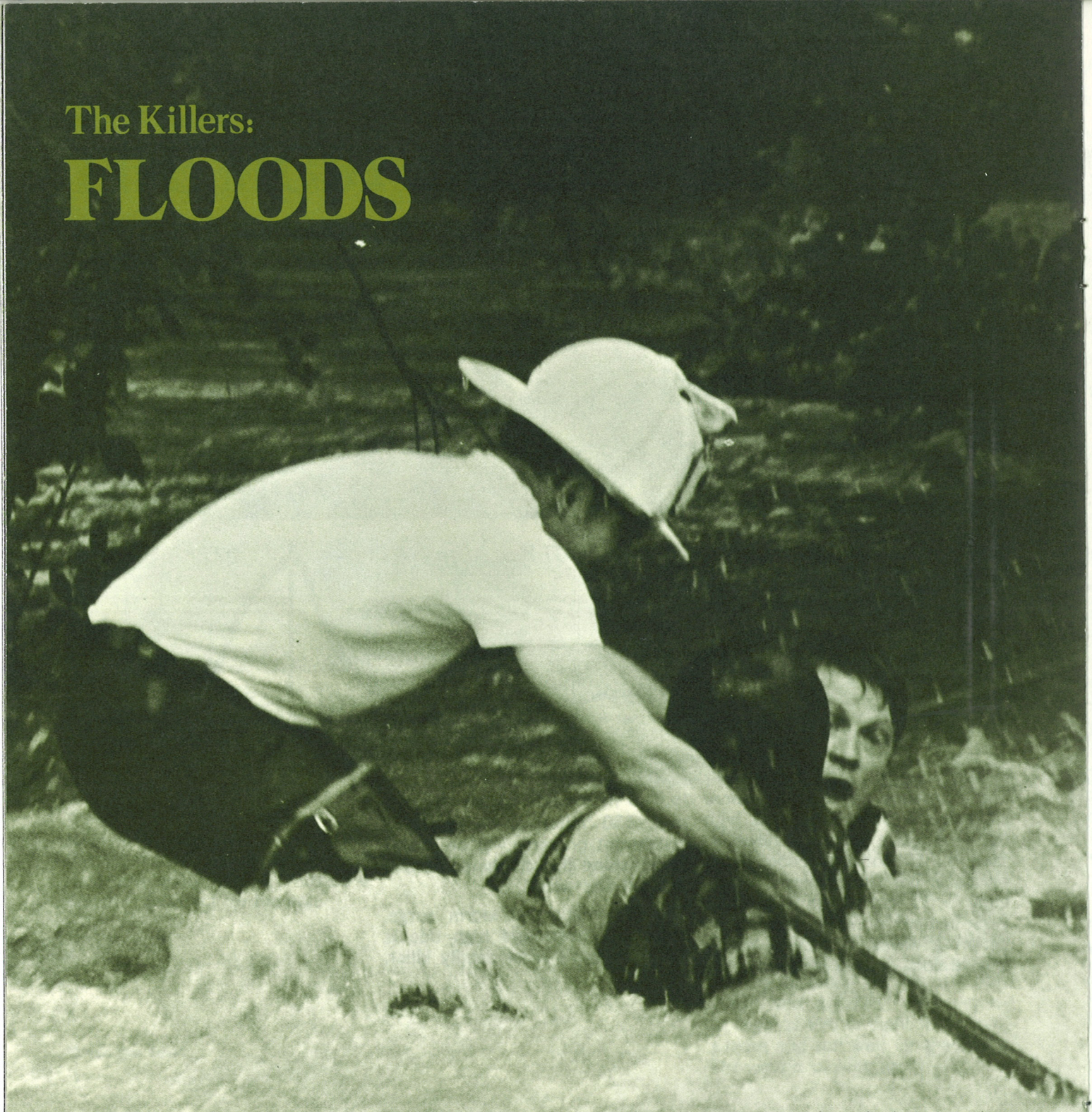




The hurricane is moving ashore close to the beach area. It is high tide time again. This time, however, there is a 15-foot surge added to the normal 2-foot astronomical tide creating a 17-foot **storm tide.** This great mound of water, topped by battering waves, is moving slowly ashore along an area of coastline 50 to 100 miles wide. Winds are now over 130 miles an hour. Much oceanfront property will be unable to withstand this combined assault of wind and water.

The combination of storm surge, battering waves, and high tide is the hurricane's most deadly killer.

The Killers:
FLOODS



Tom Manes, Killeen (Texas) Herald

The floods brought by the torrential rains of a hurricane are dangerous killers. Even though hurricanes weaken rapidly as they move inland, the remnants of the storm can bring 6 to 12 inches of rain or more to the area it crosses. The resulting floods have caused great damage and loss of life, particularly in mountainous areas. Hurricane Diane of 1955 caused little damage as it moved into the continent; but long after its winds subsided, it brought floods to Pennsylvania, New York, and New England that killed 200 persons and cost an estimated $700 million in damage. In 1972, Agnes fused with another storm system, flooding creek and river basins in the Northeast with more than a foot of rain in less than 12 hours, killing 117 people and causing almost $3 billion damage. Hurricane Beulah of 1967 brought major floods to southern Texas killing 10 persons and causing millions of dollars damage.

Action Checklist

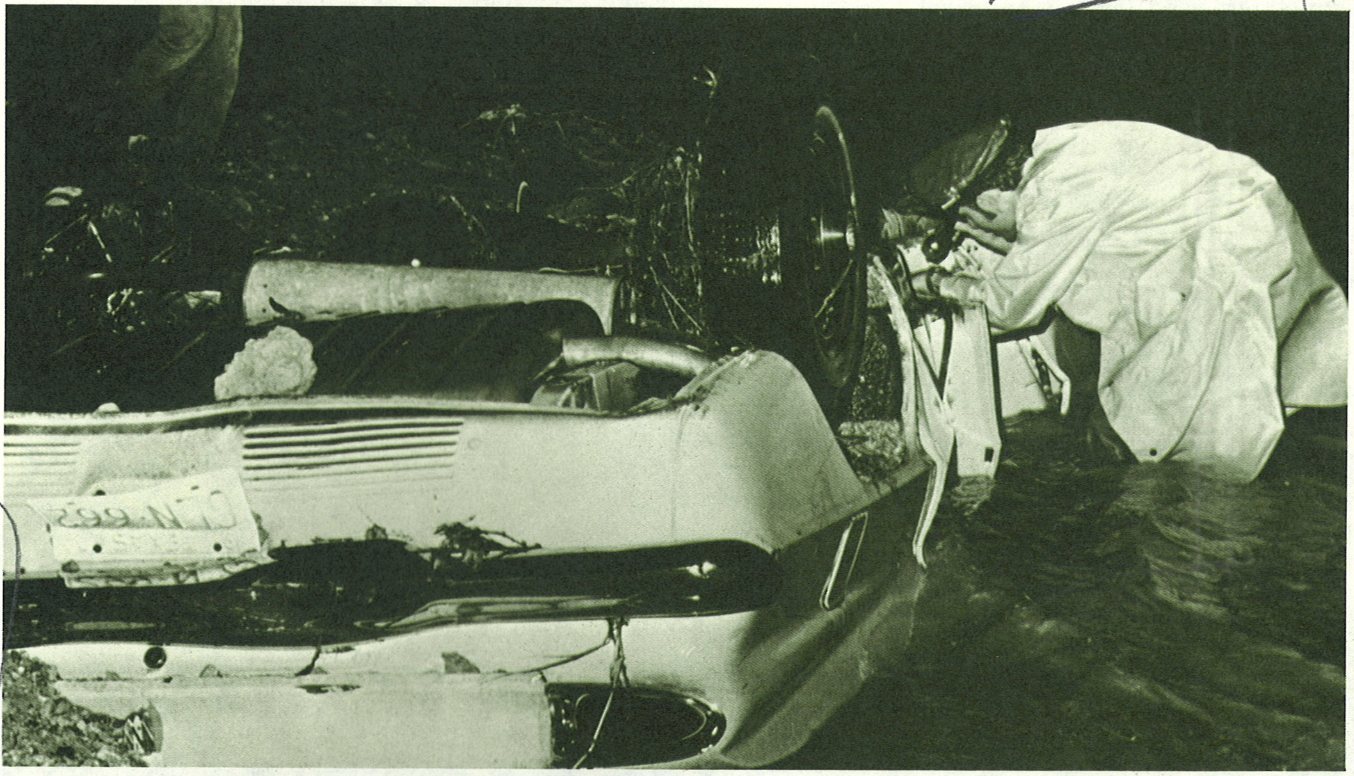
Know the height of your land in relation to gullies, streambeds and other natural water courses; and know a safe, sure route to higher ground if you should have to escape flooding.

Stay tuned to radio, television, or NOAA Weather Radio for weather bulletins and official reports.

If you learn a flood threatens your area, leave at once. In areas prone to flash floods you may have only minutes to save yourself.

Use caution in attempting to cross flooded areas. Flooding may undermine roads making them unsafe to drive on.

NO — Killeen (TEXAS) HERALD



Tom Manes, Killeen (Texas) Herald

From Am Red Cross

The Killers:

WINDS

The winds of a hurricane—by definition 74 miles an hour or more—can be very dangerous. For some structures, wind force is sufficient to cause destruction. Mobile homes are particularly vulnerable to hurricane winds.

Some hurricanes spawn tornadoes which cause incredible destruction to anything in their paths.

The greatest threat from a hurricane's winds is their cargo of debris—a deadly barrage of flying missiles such as lawn furniture, signs, roofing, and metal siding.

Action Checklist

Stay tuned to radio, television, or NOAA Weather Radio for weather bulletins and official reports.

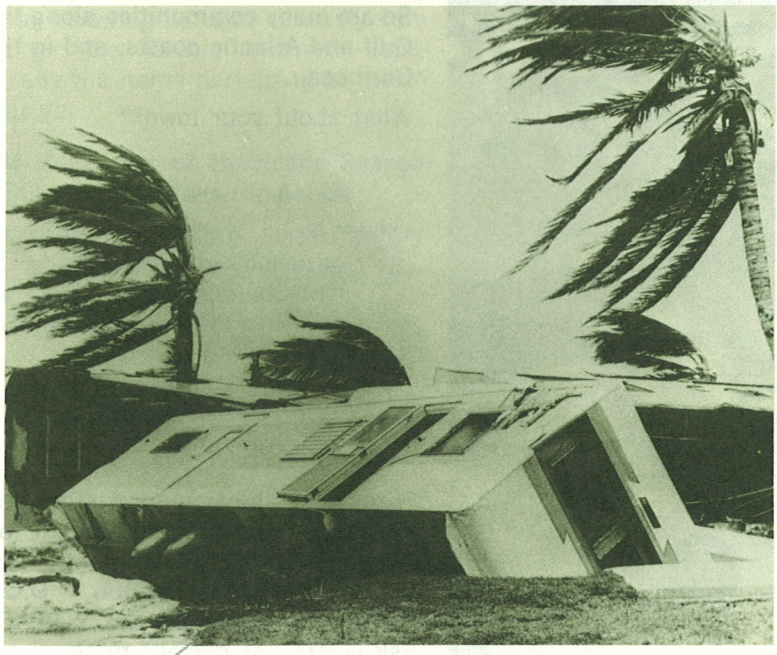
Stay at home if it is sturdy and on high ground. Travel is dangerous when strong winds and heavy rains are whipping through your area.

When a hurricane warning is issued, board up windows and glass doors or protect them with storm shutters or tape. Secure outdoor objects such as garbage cans, garden tools, toys, signs, and porch furniture.

Mobile home owners should check tie-downs and then leave when a hurricane threatens.

If you experience the eye, winds will suddenly decrease and skies may clear. Stay indoors unless emergency repairs are necessary. When the eye passes, the winds will blow from the opposite direction as strong or stronger than before.

Miami Herald



Amer. Red Cross Photo

COMMUNITY ACTION

An Imaginary Town

Beyond individual and family actions during a hurricane emergency, there is much to be done at the community level. Many communities on the Atlantic and Gulf coasts have made plans for action in the event a hurricane threatens, such as delineation of areas to be evacuated, shelter-designations, evacuation routes, and emergency operations of fire, police, and other public service units.

But many exposed coastal communities are not prepared for a hurricane, and others have waited for disaster's expensive lesson before taking corrective steps. To encourage community preparedness, NOAA's National Weather Service has invented a town, named Homeport, and made it a model of hurricane preparedness.

The citizens of Homeport have set up a hurricane preparedness committee, a permanent body consisting of civic leaders, the local civil defense director, law enforcement and disaster relief personnel, representatives of city utilities and news media, and representatives from the county, State, and Federal governments. Their first step was to assess potential hurricane dangers, particularly storm surge and floods, and then to earmark those areas of Homeport to which these dangers most applied. The City prepared maps which showed areas to be evacuated for several magnitudes of storm surge. The committee set up an emergency operation center (EOC), where auxiliary power, telephone and other emergency communications ensure the city will not be cut off from the outside world by a hurricane. Officials responsible for decisions affecting safety of Homeport's citizens will be at the EOC. Working with the Red Cross and other volunteer agencies, the committee designated stout buildings out of flood endangered areas as shelters. Additional shelters were located at inland towns near Homeport.

Homeport takes preparedness seriously. The hurricane preparedness committee meets early every summer to check the equipment and procedures. Assignments are made to law enforcement and fire protection personnel, to aircraft and boat operators, and to everyone concerned with getting Homeport through a natural disaster. And the citizens of Homeport are educated to help take care of themselves.

This does not mean that Homeport will not be damaged when a hurricane does strike. What can be saved will have been saved, and there should be no loss of life. Homeport is ready for its hurricane.

So are many communities along the Gulf and Atlantic coasts, and in the Caribbean.

What about your town?*

*Copies of The Homeport story are available from Superintendent of Documents, U.S. Government Printing Office, Washington, D.C., 20402. Stock number 0317-0046. Ask G.P.O. for current price.

(IV)

Action Checklist Recap

Here is a list of the many things to consider before, during and after a hurricane. Some of the safety rules will make things easier for you during a hurricane. All are important and could help save your life and the lives of others.

Stay or Leave

When a hurricane threatens your area, you will have to make the decision whether you should evacuate or whether you can ride out the storm in safety at home.

If local authorities recommend evacuation, you should leave! Their advice is based on knowledge of the strength of the storm and its potential for death and destruction.

In general:

- If you live on the coastline or offshore islands, **plan to leave.**
- If you live in a mobile home, **plan to leave.**
- If you live near a river or in a flood plain, **plan to leave.**
- If you live on high ground, away from coastal beaches, **consider staying.**

In any case, the ultimate decision to stay or leave will be yours. Study the following list and carefully consider the factors involved—especially the items pertaining to storm surge.

At Beginning of Hurricane Season (June) Make Plans for Action

- Learn the storm surge history and elevation of your area
- Learn safe routes inland
- Learn location of official shelters
- Determine where to move your boat in an emergency
- Trim back dead wood from trees

When a Hurricane Watch is Issued for Your Area

- Check often for official bulletins on radio and TV
- Fuel car
- Check mobile home tie-downs
- Moor small craft or move to safe shelter
- Stock up on canned provisions
- Check supplies of special medicines and drugs
- Check batteries for radio and flashlights
- Secure lawn furniture and other loose material outdoors
- Tape, board, or shutter windows to prevent shattering
- Wedge sliding glass doors to prevent their lifting from their tracks

When a Hurricane Warning is Issued for Your Area

- Stay tuned to radio or TV for official bulletins
- Stay home if sturdy and on high ground.
  - Board up garage and porch doors
  - Move valuables to upper floors
  - Bring in pets
  - Fill containers (bathtub) with several days supply of drinking water
  - Turn up refrigerator to maximum cold and don't open unless necessary
  - Use phone only for emergencies
  - Stay indoors on the downwind side of house away from windows
  - Beware of the eye of the hurricane
- Leave mobile homes
- Leave areas which might be affected by storm tide or stream flooding
  - Leave early—in daylight if possible
  - Shut off water and electricity at main stations
  - Take small valuables and papers but travel light
  - Leave food and water for pets (shelters will not take)
  - Lock up house
  - Drive carefully to nearest designated shelter using recommended evacuation routes.

After the All-Clear is Given

- Drive carefully; watch for dangling electrical wires, undermined roads, flooded low spots
- Don't sight-see
- Report broken or damaged water, sewer, and electrical lines
- Use caution re-entering home
  - Check for gas leaks
  - Check food and water for spoilage

Words of Warning

Small craft cautionary statements. When a tropical cyclone threatens a coastal area, small craft operators are advised to remain in port or not to venture into the open sea.

Gale Warnings may be issued when winds of 39–54 miles an hour (34–47 knots) are expected.

Storm Warnings may be issued when winds of 55–73 miles an hour (48–63 knots) are expected.

If a hurricane is expected to strike a coastal area, gale or storm warnings will not usually precede hurricane warnings.

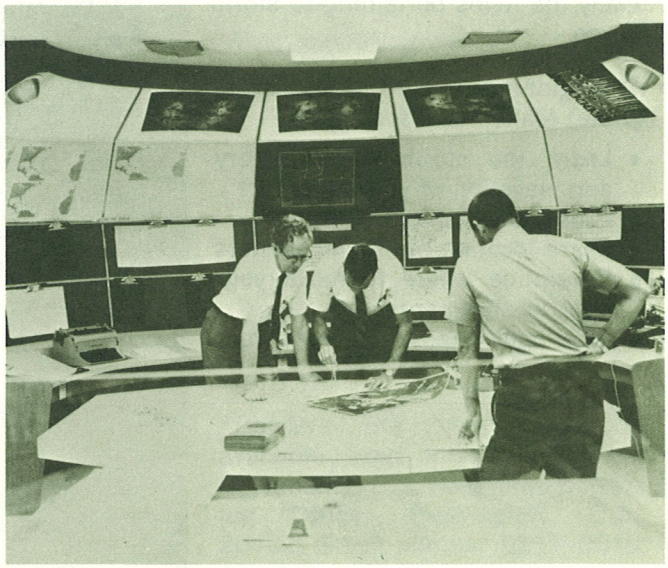
A **Hurricane Watch** is issued for a coastal area when there is a threat of hurricane conditions within 24–36 hours.

A **Hurricane Warning** is issued when hurricane conditions are expected in a specified coastal area in 24 hours or less. Hurricane conditions include winds of 74 miles an hour (64 knots) and/or dangerously high tides and waves. Actions for protection of life and property should begin immediately when the warning is issued.

Flash Flood Watch means a flash flood is possible in the area; stay alert.

Flash Flood Warning means a flash flood is imminent; take immediate action.

Tornadoes spawned by hurricanes sometimes produce severe damage and casualties. If a tornado is sighted in your area, a warning will be issued.



For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402 - Price 90 cents

Stock No. 003-018-00073-3

There is a minimum charge of $1.00 for each mail order